

Effect of Moisture Content on Quality of Vermicompost and Specific Earthworm (*Periyonix excavatus*) Population

D.P.A. Mihirangi

Uva Wellassa. University, Badulla, Sri Lanka

J.D. Weerasooriya

Fruit Crop Research & Development Center, Horana, Sri Lanka

and

N.S. Withanage

Uva Wellassa. University, Badulla, Sri Lanka

Introduction

The aim of the present agriculture practices is to be obtaining high yield using genetically modified, sterilized hybrid seed. The other side of modernization was degradation of fertile agricultural lands due to dependence on chemical fertilizer, pesticides and herbicides. Continuous use of those inputs has damaged the biodiversity. Vermicomposting is an ecofriendly, socially sound and economically viable technology to protect environment. Vermicompost contains not only worm castings, but also bedding materials and organic wastes at various stages of decomposition. Therefore, it provides high porosity, moisture content, aeration and water holding capacity. And also it has been shown to have higher level of organic carbon, total and available N, P, K and other micronutrients, microbial and enzyme activities and plant growth regulators. Therefore, it can be a good replacement to chemical fertilizer. Even though vermicomposting is an age old process, due to rapid changes in technology in present scenario it is essential to change such process with application of advanced technique available. The moisture content plays a significant role in the process of vermicomposting. Therefore the objective of this study was to evaluate the effect of moisture content on quality of vermicompost and *Periyonix excavatus* earthworm population.

Methodology

The laboratory experiments and field experiments were conducted at the Fruit Crop Research and Development Center (FCRDC) Horana from March 2011 to August 2011. The experiment was carried out in shade hut. Complete randomized design (CRD) was used as the experimental design. Available container (cement tanks 2ft×3ft) is cleaned for removing unwanted material and covered the excess holes. Collected raw materials (Banana stems, Grass, *Gliricidia*, Cattle manure) were shredded to small pieces. The available moisture content was checked in the raw materials. *Gliricidia* (4.5 kg), grasses (4.5 kg), Banana stems (1 kg) and Cattle manure (10 kg) were weighed and placed them in one container layers. Bottom of the tank was filled with a cattle manure layer of 2 inches thickness and over it grasses, *Gliricidia*, Banana stems layers placed respectively, alternating with Cattle manure at 1 inch thickness layers with different moisture content from 50 ± 5%, 60 ± 5%, 70 ± 5%, 80 ± 5%, 90 ± 5%. One treatment marked as control has moisture content maintained at 80 ± 5% without earthworm. There were three replicates for each treatment.

Then moisture level was maintained according to the treatments continuously by adding water once a week. Moisture content was measured by drying the samples in a hot air oven at 105°C for 24 hours. Cattle manure and other feed materials are thoroughly mixed once a

week manually and Check the temperature daily. *Perionyx excavatus* were added (600 earthworms approximately same size 6- 8cm each tank) after 2 weeks of partial decomposition of organic waste (at room temperature or below 29°C) for all treatments without controller. After 45 days of earthworm introduction, final samples were collected for nutrient analysis (N, P, K, Ca, Mg, C, C/N ratio). Earthworms were counted at the end of the vermicomposting.

Results and discussion

The composition of vermicompost is given in Table 1.

Table 1: Composition of Vermicompost

Treatments	N %	P %	K %	Ca %	Mg %	C %	C/N ratio
T1(control)	0.443 ^c	0.391 ^c	0.312 ^{cd}	2.79 ^{bc}	0.786 ^{bc}	21.99 ^a	52.96 ^a
T2	0.410 ^c	0.380 ^c	0.260 ^c	2.00 ^c	0.686 ^c	12.20 ^b	29.81 ^b
T3	0.426 ^c	0.404 ^{bc}	0.283 ^{de}	2.76 ^{bc}	0.743 ^{bc}	11.08 ^c	25.99 ^b
T4	0.539 ^b	0.541 ^{ab}	0.364 ^b	4.30 ^a	0.956 ^{bc}	10.34 ^d	19.16 ^c
T5	0.634 ^a	0.660 ^a	0.414 ^a	4.73 ^a	1.283 ^a	9.27 ^e	14.67 ^c
T6	0.513 ^b	0.417 ^{bc}	0.334 ^{bc}	3.13 ^b	1.026 ^{ab}	9.57 ^e	18.64 ^c

*Mean with same letter is not significantly different at 5% level

According to Gajalakshmi, 2003, organic matter decomposition rate is reduced by the anaerobic condition in the presence of high moisture content, especially reducing the activity of both worms and micro organisms, therefore the N, P, K, Ca and Mg content has been increased with increasing moisture content up to T5 (80 ± 5%), however it has been decreased in T6 (90 ± 5%). Further according to Gajalakshmi, 2003, earthworm castings are enriched in mineral N, P, K. Further, the Earthworm population had doubled in the treatment T5 which was with 80 ± 5% moisture content. According to the Table1, vermicompost T5 with 80 ± 5% moisture content has recorded maximum level of N (0.634%), P (0.66%), K (0.414), Ca (4.73%) and Mg (1.28%).

The evaluation of Carbon and C/N ratio in each treatment resulted a different pattern than the N, P, K, Ca and Mg. Carbon content and C/N ratio were higher in the control. Lower C content and C/N ratio were observed in the T5. Thus the results were comparatively opposites of the N, P, K, Ca, Mg nutrients level pattern. Because of the earthworms got their energy through the Carbon. In the changing pattern of C released by carbohydrate degradation and establish. The Edwards and Lofty (1977) indicated that it is mainly due to combusting of carbon during respiration. Alagesan, 2010 pointed out that decomposition of organic matter is brought about by living organisms that use more C than N as a source of energy and thus the amount of carbon is reduced to a more suitable level while N is recycled. Alagesam (2010) reported that lowering of C/N ratio is due to loss of Carbon in bacterial metabolism.

Chemical analysis of vermicompost in treatment T5 (80 ± 5%) showed maximum level of N (0.634%), P (0.66%), K (0.414), Ca (4.73%) and Mg (1.28%). The level of C (9.27%), C/N ratio (14.67) was minimized in 80 ± 5% moisture content vermicompost processed by *Perionyx excavatus* comparison to the other treatments. The height 5 - 25cm, temperature 25 - 32°C, pH 5 - 7, EC 300 - 400µs have fluctuated within vermicomposting period.

Conclusions

It can be concluded that approximately 80 ± 5 % moisture content is optimum for quicker stabilization of the organic solid waste using *Perionyx excavatus*. The study reveals that the content of nutrients is greatly influenced by the moisture content of the substrate and varies with time.

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